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INSIGHTS FROM UNIFIED
GROWTH THEORY**

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ABSTRACT

Multiple Growth Regimes – Insights from Unified Growth Theory*

Unified Growth Theory uncovers the forces that contributed to the existence of multiple growth regimes and the emergence of convergence clubs. It suggests that differential timing of take-offs from stagnation to growth segmented economies into three fundamental regimes: slow growing economies in a Malthusian regime, fast growing countries in a sustained growth regime, and economies in the transition between these regimes. In contrast to existing research that links regime switching thresholds to critical levels of income or human capital, UGT associates them with critical changes in the rates of technological progress, population growth, and human capital formation.

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Keywords: convergence clubs, Malthusian epoch, sustained growth and unified growth theory

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1. Introduction

The quest for an empirical determination of the forces that have contributed to the existence of multiple growth regimes and the emergence of convergence clubs, although central for the understating of the process of development, has not been shared by a portion of researchers in the field of economic growth.³ This dichotomy may reflect fundamental differences in perception regarding the significance of these phenomena in the process of development.

Contributors to the empirical literature on multiple growth regimes have faced an increasing challenge of motivating their findings in the context of growth models that are widely perceived as plausible. The dominating tendency among researchers in the field to rationalize their empirical investigations by underlying growth models that generate multiple long-run equilibria have undermined this important endeavor and deprived it from the central stage in the growth literature.⁴

The theoretical framework that has been used to rationalize many of these empirical studies has drawn criticism that to a large extent is not unjustified. Many, and perhaps rightly so, have been skeptical about the characterization of the world economy in terms of multiple long-term equilibria that segment economies into convergence clubs (e.g., Azariadis and Drazen, 1990). If indeed, as argued by some, there is a threshold that a country ought to surpass in order to join the club of the rich economies, and if this threshold is insurmountable in the absence of an exogenous shock (e.g., foreign aid, foreign capital inflow, etc.), then how did the rich economies in today's world surpass this threshold in the distant past when their level of development was similar to those in poverty traps today?

The recent advance of Unified Growth Theory (UGT) provides an empirically plausible framework that could be used to interpret existing empirical findings and guide future empirical investigations about the underlying sources of multiple growth regimes and the emergence of convergence clubs. The theory suggests that, although the long-run equilibrium may not differ across economies, differential timing of take-offs from stagnation to growth segmented economies into three fundamental regimes the differ in their growth structure: slow growing economies in the vicinity of a Malthusian regime, fast growing countries in a sustained growth regime, and a third group of economies in the transition from one regime to another. Convergence clubs, therefore, may be temporary, and endogenous forces would permit economies to shift from the Malthusian Regime into the sustained growth regime. In contrast to existing research that links memberships in each club and the thresholds that permit economies to switch across these regimes to critical *levels* of income or human capital, Unified Growth Theory suggests that they are in fact associated primarily with critical *changes* in the rates of technological progress, population growth and human capital formation.

³ Growth non-linearities and convergence clubs were explored empirically by Durlauf and Johnson (1995), Quah (1997), and Durlauf and Quah (1999). More recent studies include Papageorgiou and Chmelarova (2005) and Graham and Temple (2006).

⁴ A notable exception is Durlauf and Johnson (1995) who provide a broader interpretation that includes, in addition to multiple long-run equilibria, a world characterized by a unique long-run equilibrium, but different stages of development.

2. Unified Growth Theory

The transition from stagnation to growth and the associated phenomenon of the great divergence have been the subject of intensive research in the growth literature in recent years.⁵ The inconsistency of exogenous and endogenous growth models with some of the most fundamental features of the process of development has led to a search for a unified theory that would unveil the underlying micro-foundations of the entire growth process and would capture in a single framework the epoch of Malthusian stagnation that characterized most of human history, the contemporary era of modern economic growth, and the driving forces that triggered the recent transition between these regimes.

The advance of Unified Growth Theory was fuelled by the conviction that the understanding of the contemporary growth process would be fragile and incomplete unless growth theory would be based on proper micro-foundations that reflect the various qualitative aspects of the entire growth process and their central driving forces. Moreover, it has become apparent that a comprehensive understanding of the hurdles faced by less developed economies in reaching a state of sustained economic growth would remain obscure unless the factors that prompted the transition of the currently developed economies into a state of sustained economic growth could be identified and modified to account for the differences in the growth structure of less developed economies in an interdependent world. Unified growth theory explores the fundamental factors that generated the remarkable escape from the Malthusian epoch and their significance in understanding the contemporary growth process of developed and less developed economies. Moreover, it sheds light on the perplexing phenomenon of the great divergence in income per capita across regions of the world in the past two centuries that ultimately led to the clustering of countries into convergence clubs.

Unified Growth Theory (Galor and Weil, 1999; 2000; Galor and Moav, 2002 and Galor 2005) suggests that the transition from stagnation to growth is largely an inevitable outcome of the process of development. The inherent Malthusian interaction between the level of technology and the size and the composition of the population accelerated the pace of technological progress and ultimately raised the importance of human capital in the production process. The rise in the demand for human capital in the second phase of industrialization and its impact on the formation of human capital as well as on the onset of the demographic transition brought about significant technological advances along with a reduction in fertility rates and population growth. It enabled economies to convert a larger share of the fruits of factor accumulation and technological progress into growth of income per capita, rather than population growth, paving the way for the emergence of sustained economic growth.

Differences in the timing of the take-off from stagnation to growth across countries contributed significantly to the great divergence and to the emergence of convergence clubs. These variations reflect initial differences in geographical factors and historical accidents and their manifestation in the diversity of institutional, demographic, and cultural factors, as well as in trade patterns, colonial status, and public policy across countries and regions. In particular, once a technologically driven demand for human capital emerged in the second phase of industrialization, the prevalence of human capital-promoting institutions or policies determined the extensiveness of human capital formation, the timing of the demographic transition, and the

⁵ See Galor and Weil (1999; 2000), Galor and Moav (2002), Lucas (2002), Hansen and Prescott (2002), Hazan and Berdugo (2002), Doepke (2004), Boucekine, de la Croix and Peeters (2006), and Lagerlof (2006).

pace of the transition from stagnation to growth.⁶ Thus, unified growth theory provides the natural framework of analysis in which differences in the economic performance across countries and regions could be examined based on the effect of variations in educational, institutional, geographical, and cultural factors on the pace and the timing of the transition from stagnation to growth.⁷

3. Implication for Multiple Growth Regimes

Consistently with contemporary evidence about the existence of multiple growth regimes, the existence of variations in the timing of the transition from stagnation to sustained economic growth across countries suggests that in any time period in which the universal transition has not been completed, countries would be observed in different stages of development. Economies would be segmented into three fundamental groups. Two convergence clubs of rich and poor economies and a third group of countries in the transition from one club to another. Importantly, this segmentation does not reflect the long-run steady-state of these economies, as would be implied by models characterized by multiple steady-state equilibria. Rather, it is a reflection of variations in the timing of the escape from a Malthusian trap and thus in the position of countries along the growth trajectory from Malthusian stagnation to sustained economic growth.

Technological leaders largely experience a monotonic increase in the growth rates of their per capita incomes along the process of development. Their growth is slow in early stages of development, it increases rapidly during the take-off from the Malthusian epoch, and it continues to rise, often stabilizing at higher levels in the sustained growth regime. In contrast, technological followers that made the transition to sustained economic growth more recently experience a non-monotonic increase in the growth rates of their per capita incomes. Their growth rate is slow in early stages of development and it increases rapidly during their take-off from the Malthusian epoch, boosted by the adoption of technologies from the existing technological frontier. However, once these economies reach the technological frontier, their growth rates drop to the level of the technological leaders.

Unified Growth Theory suggests that two major transformations in the growth process would determine the thresholds between the club of the slow growing economies, countries in a transition from one club to another, and the club of the fast growing economies. The first threshold is associated with rapid increase in the rates of technological progress and population growth, and the second with significant rise in human capital formation along with a rapid decline in population growth.

Variations in the *levels* of income, human capital, and population growth across countries, in contrast, would not be indicative of these thresholds, and would only reflect the specific characteristics of countries (e.g., geographical factors and historical accidents and their manifestation in the diversity of institutional, demographic, and cultural factors, as well as in trade patterns, colonial status, and public policy) rather than their actual stage of development. For instance, although during the 18th century education levels were significantly lower in England than in continental Europe, England was the first to industrialize and to take-off towards

⁶ Galor and Moav (2006), Galor, Moav and Vollrath (2006), O'Rourke, and Williamson (2005), Lord and Rangazas (2006), and Voigtländer and Voth (2006)

⁷ See Galor and Mountford (2003, 2006), and Ashraf and Galor (2007).

a state of sustained economic growth.⁸ Similarly, the demographic transition that marked a regime switch to a state of sustained economic growth occurred in the same decade across Western European countries that differed significantly in their income per capita. In 1870, on the eve of the demographic transition, England was the richest country in the world, with a GDP per capita of \$3191.⁹ In contrast, Germany that experienced the decline in fertility in the same years as England, had in 1870 a GDP per capita of only \$1821 (i.e., 57% of that of England). Sweden's GDP per capita of \$1664 in 1870 was 48% of that of England, and Finland's GDP per capita of \$1140 in 1870 was only 36% of that of England, but their demographic transitions, and hence their switch to the sustained growth regime, occurred in the same decade as well.

Thus, unlike existing research that attempts to link the thresholds between the various convergence clubs to critical *levels* of income or human capital, Unified Growth Theory suggests that they are in fact associated primarily with critical *changes* in the rates of technological progress, population growth and human capital formation.

⁸ The early development of public education occurred in the western countries of continental Europe (e.g., Prussia, France, Sweden, and the Netherlands) well before the Industrial Revolution. The provision of public education at this early stage was motivated by several goals such as social and national cohesion, military efficiency, enlightenment, moral conformity, sociopolitical stability as well as religious reasons.

⁹ Measured in 1990 international dollars, Maddison, (2001).

References

- Ashraf, Q., Galor O., 2007. Cultural assimilation, cultural diffusion, and the origin of the wealth of nations. Working Paper 2007-03, Brown University.
- Azariadis, C., Drazen, A., 1990. Threshold externalities in economic development. *Quarterly Journal of Economics* 105, 501-526.
- Boucekkine, R., de la Croix, D., Peeters, D., 2006. Early Literacy Achievements, Population Density, and the Transition to modern Growth, *Journal of the European Economic Association* 5, 183–226.
- Doepke, M., 2004. Accounting for fertility decline during the transition to growth. *Journal of Economic Growth* 9, 347–83.
- Durlauf, S.N., and Johnson, P.A., 1995. Multiple regimes and cross-country growth behavior. *Journal of Applied Econometrics* 10, 365–384.
- Durlauf, S.N., Quah, D., 1999. The new empirics of economic growth. In Taylor J.B., Woodford M. (Eds.), *Handbook of Macroeconomics*, North Holland, Amsterdam.
- Galor, O., 2005. The transition from stagnation to growth: Unified growth theory. In Durlauf, S., Aghion, P., (Eds.), *Handbook of Economic Growth*, North Holland, Amsterdam.
- Galor, O., Moav, O., 2002. Natural selection and the origin of economic growth. *Quarterly Journal of Economics* 117, 1133–1192.
- Galor, O., Moav, O., 2006. Das human-kapital: a theory of the demise of the class structure. *Review of Economic Studies* 73, 85–117.
- Galor, O., Moav O., and Vollrath, D., 2006. Inequality in land ownership, the emergence of human capital promoting institutions, and the great divergence. Brown University.
- Galor, O., Mountford, A., 2003. Trading population for productivity. Brown University.
- Galor, O., Mountford, A., 2006. Trade and the great divergence: the family connection. *American Economic Review* 96, 299–303.
- Galor, O. Weil, D.N., 1999. From Malthusian stagnation to modern growth. *American Economic Review* 89, 150–4.
- Galor, O., Weil, D.N., 2000. Population, technology and growth: from the Malthusian regime to the demographic transition and beyond. *American Economic Review* 110, 806–28.
- Graham, B. S., Temple, J.R.W., Rich nations, poor nations: how much can multiple equilibria explain? *Journal of Economic Growth* 11, 5-41.
- Hansen, G., Prescott, E., 2002. Malthus to Solow. *American Economic Review* 92, 1205–17.
- Hazan, M., and Berdugo, B., 2002. Child labor, fertility and economic growth. *Economic Journal* 112, 810–28.
- Lagerlof, N., 2006. The Galor–Weil model revisited: a quantitative exploration. *Review of Economic Dynamics* 9, 116–42.
- Lord, W., Rangazas, P., 2006. Fertility and development: the roles of schooling and family production, *Journal of Economic Growth* 11, 229-261.
- Lucas, R.E., 2002. *The Industrial Revolution: Past and Future*. Harvard University Press, Cambridge, MA.
- Maddison, A., 2001. *The World Economy: A Millennia Perspective*. OECD, Paris.
- O'Rourke, K.H., Williamson, J.G., 2005. From Malthus to Ohlin: Trade, industrialization and distribution since 1500. *Journal of Economic Growth* 10, 5-34.
- Papageorgiou, C., and Chmelarova, V., 2005. Nonlinearities in capital–skill complementarity. *Journal of Economic Growth* 10, 55-86.
- Voigtländer, N., and Voth, H-J., 2006. Why England? Demographic factors, structural change and physical capital accumulation during the Industrial Revolution. *Journal of Economic Growth* 11, 319-361.